DOCUMENT RESUME

ED 140 225 CS 003 389

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TITLE Assessing Reading Comprehension.
PUB DATE May 77
NOTE 19p.; Paper presented at the Annual Meeting of the International Reading Association (22nd, Miami Beach, Florida, May 2-6, 1977)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Cognitive Processes; Educational Assessment; Elementary Secondary Education; Literature Reviews; *Reading Comprehension; *Reading Processes; *Reading Research; Reading Skills; *Reading Tests; *Test Validity; Theories

ABSTRACT

Many instruments designed to assess reading comprehension reflect instructional tasks that have not clearly been shown to be a part of the process of comprehension. If the measurement instruments are to have construct validity, however, they must be created to reflect what we know about cognitive processing. Recent work in cognitive psychology has begun to aid us in codifying some of the basic factors or elements of comprehension. Three particular areas of research in cognitive psychology are explored as potential sources of items and activities for assessing reading comprehension: imagery and associational aids in recall; network theory relating classes and examples of concepts; and "scripts" that contain information about situations encountered with regularity. (AA)

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Assessing Reading Comprehension

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Processes and Tasks of Reading Comprehension

In order to develop perspectives regarding the assessment of reading comprehension, one must develop satisfactory definitions of both the processes and tasks involved for a reader to comprehend written discourse. Definitions are vital when discussing comprehension. It becomes crucial to understand what goes on inside the reader's head and how that relates to assessment and instruction of reading comprehension.

What are the probable processes involved in reading comprehension? I can begin by suggesting that the psychological processes of reading comprehension are similar to those involved in all other communications processes. That is, whether listening, speaking, reading or writing, we assume that comprehension is a complex series of cognitive and language factors operating in tandem that assist humans in gaining meanings during communication. These interrelationships aid in obtaining meaning. Comprehension, then, is the acquisition of meaning as a result of some form of language communication. These meanings occur as the individual is aware of, receives, perceives, processes, stores and/or retrieves information from external stimulation. Comprehension is the process of internalizing external events or stimuli for the purposes of obtaining meaning.

Presented at the Annual Convention of the Internation Reading Association, May, 1977.

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Reading tasks, on the other hand, are the skills and/or activities that make up the instructional aspects of comprehension. They are the things we ask students to complete in an attempt to learn to read. They may be worksheets, workbook materials, discussion questions, fill-in-the-blank exercises, and other forms of materials that reflect the instructional components of reading. We refer to these tasks as the content of reading. But by themselves, they do not make up the processes of reading comprehension. Often the difficulties associated with assessment of reading comprehension come about because we assume the cognitive processes and the tasks we have generated to teach reading comprehension are one and the same. This is often not the case in the assessment of reading comprehension.

Many comprehension instruments reflect instructional tasks that have not clearly been shown to be part of the processes of comprehension. For example, suppose we ask students to identify the main idea of a passage, locate its significant details or read the passage critically. After reading the passage, the student is directed to answer several questions. We provide the questions and then ask the student to choose, from alternative answers, the one statement that provides the best answer. Have we really defined the main idea, significant details or critical reading before asking the student to locate answers to our questions? That is, do our own labels insure that something is what we call it? As an aside, isn't the student's own definition of the main idea and the significant details and his/her answer to that question more revealing of the cognitive processes used to comprehend the passage?

Another situation becomes apparent when we examine most standardized measures of reading comprehension. The items are created to distribute

student scores along a continuum of good to poor performance. Thus, the items that are finally used in the assessment instrument discriminate among students taking the test. These items may be later revised so that only a few students get the correct score. The correct response, while it may be a useful index of student performance in relation to his/her peers, may or may not reflect the student's level of cognitive processing. Choosing the correct response may reflect the student's ability to detect the item writer's level of cognitive processing. This simply means that student scores on standardized tests of reading comprehension reflect but one aspect of written language comprehension. It further suggests than an adequate assessment of reading comprehension must include both standardized and teacher-made instruments. Teacher-made assessments include both structured and nonstructured activities, Thus, the kinds of questions teachers write and those they ask to assess reading comprehension become a vital part of assessment.

The ideal measurement instrument of reading comprehension, I submit, is one that purposely sets about assessing reading tasks that have been created to reflect what we know about cognitive processing. Thus, the critical issue in creating reading comprehension instruments is construct validity. That is, do the tasks reflect what research has demonstrated to be the underlying traits or processes of comprehension?

Recent work in cognitive psychology has begun to aid us in codifying some of the basic factors or elements of comprehension. As Anderson suggests,

> We now have a conception of the processes involved in learning from written discourse which, while tentative and incomplete,

> provides a useful beginning. . . . Elements of text are first encoded in terms of perceptual features. Since the relevant perceptual features of text are orthographic, this can be called orthographic encoding. The next level of processing probably involves acoustic features. At this stage, which can be called phonological encoding, strings of words are rendered into implicit (or explicit) speech. Finally, there may be semantic encoding, that is, the person may bring to mind meaningful representation based on the words he sees, or hears himself saying. Of course, a person must be able to coordinate the "surface information" embodied in the orthographic and phonological codes in terms of linguistic rules. (Anderson, pp. 145-6, 1972)

Let us look at some of the elements or factors that seem to reflect the underlying processes involved in reading comprehension.

I wish to pose three possible areas chosen from research in cognitive psychology that have potential as sources for items and/or activities that assess reading comprehension. These sources are not seen as mutually exclusive or statistically independent levels. They are more than likely highly interrelated. They reflect recent research efforts in semantic encoding and retrieval, and as such could be used appropriately for the selection of various types of items. Following a brief description of each of the areas will be examples chosen from standardized tests that attempt to illustrate the levels. Also informal questioning strategies and suggestions for assessment will be made.

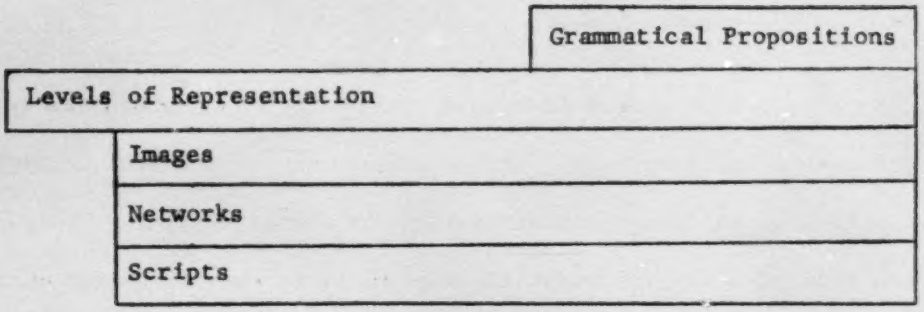


Figure 1. Semantic Encoding Processes of Comprehension

Grammatical Propositions in Comprehension

We know that the meaning of a sentence or passage is more than the sum total of the separate meanings of the words used to express the idea. How are words interrelated to communicate meanings involving a series of concepts? The answer to this question has been suggested by both Chomsky (1967) and Fillmore (1968). These writers, and others, have developed a system of rules or propositions that suggest that we automatically predict how strings of words are interrelated for the purposes of obtaining meaning.

Grammatical interrelationships are described as a system of rules governing relationships among and between words that aid in transforming deep structure (meaning structure) to surface structure. These rules are overlearned and automatic. We rarely think of them unless we perceive some interference that hinders meaning. Thus in the sentence: Dogs scare cats, we give no thought to the order in which these words appear on the page. If the sentence appears: Cats dogs scare, we stop and ponder some possible meanings. When describing language, it is appropriate to distinguish between the words that are used to express spoken or written ideas and the semantic representation of those ideas. Words

that are comprised of speech sounds or their written counterparts represent the surface of language. Surface structure may parallel orthographic and phonological encoding that Anderson referred to earlier. That is, sentence order is only important in communication when it is perceived as disorder. Words, then, are used to express inner thought and meaning. Thus, we wish to know whether or not people can perceive the deep or meaning structure of sentences. Since the normal student enters the educational system in command of the rules that translate surface structure to deep structure, and since, as Anderson points out, these are separate from the semantic encoding processes involved in comprehension, we should assume that the grammatical processes are working adequately and need not be assessed.

Representation in Comprehension and Tasks for Assessment: Imagery

It is at the level of semantic encoding, to which Anderson refers, that reading comprehension assessment must take place. Several writers (Bruner; Neiser, 1967; Sticht, 1975) have suggested that recall of information is aided by imagery and associational phenomena. Thus, a mental representation of a previously learned or encountered concept or event occurs when we recall that event. It is suggested that we have mental "pictures" or traces of concepts stored in memory. Thus, Andersor (1972) cited two types of recall phenomena theory: images and semantic features. Image theory suggests that, when presented with a verbal stimulus, individuals are able to reconstruct mental pictures of concepts. This is true to the extent that the concept has picturable properties. Consequently, abstract concepts would be less amenable to image reconstruction than concrete, readily defined concepts. Hence it is easier to reconstruct

an image of "dog" than "republican form of government." Sticht (1975) refers to this phenomenon as an iconic mode of representation. He extends this notion to suggest that we have mental programs stored in memory that allow us to externalize certain concepts by drawing pictures. Thus, an initial level of assessment reflecting cognitive processes would involve tasks that emphasize pictographic stimuli or responses. It would be appropriate to use pictures to represent concepts. Concepts would be represented by words. After reading or listening to words or sentences, students might be asked to identify a picture that represents the concept. The following types of items illustrate this level of semantic encoding.

Insert Figure 2

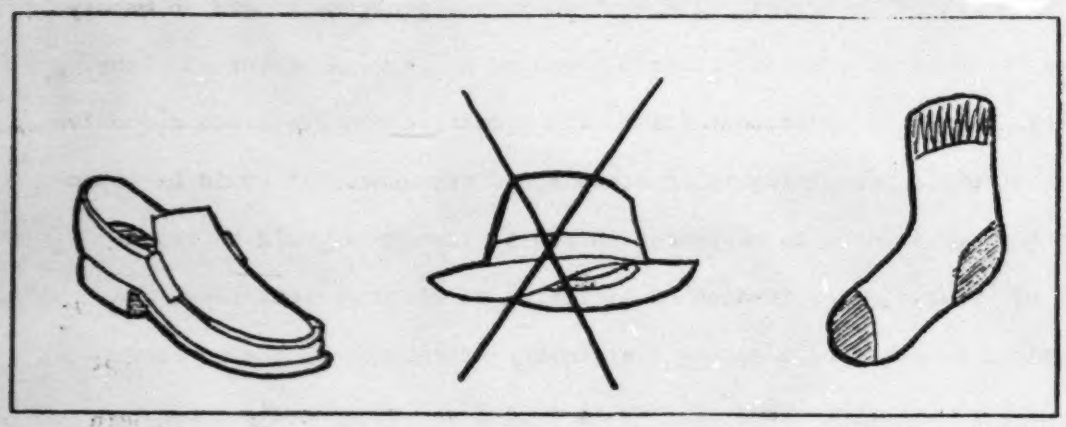
Network Representations

Network theorists (Collins and Quillian, 1969; Lindsay and Norman, 1972) provide data indicating that semantic encoding and retrieval result from stored concepts and their attributes. They state that we bring to consciousness not only the stored concepts but their accompanying attributes. These concepts are stored in an hierarchical order and categorized by unique features or attributes. Thus, things are ordered, in memory, according to their membership in classes. We relate classes by examples and categorize them on the basis of their physical and/or functional features. Concept storage and retrieval is also aided by specific examples of each concept held in memory. Concepts, then, are categorized on the basis of their attributes, into which class they fall, and by specific examples. When individuals are presented with stimuli, either verbal or written, they perform a memory search to locate previously

Figure 2

EXAMPLES OF IMAGE REPRESENTATION ASSESSMENT

Mark an X on the hat.



(Boehm, 1969)

Circle the shoe.

(Lorge, Thorndike, & Hagen 1964)

Circle the picture that shows raining.

(Lorge, Thorndike, & Hagen, 1964)

encountered classes, examples, or features. This associational process then becomes a critical aspect of comprehension. Various experimental settings have been utilized to verify semantic searching processes. Word association tasks and verification of responses to propositional statements by answering either true or false have been utilized to confirm network theories. Thus, an assessment of reading comprehension utilizing tasks from network theory would include tasks that involve verification of conceptual hierarchical structures. It would further include tasks that involve identifying classes and examples of concepts. The number of features an individual could identify and the time required to identify those features would be two critical dependent variables in the assessment of reading comprehension. The following examples illustrate this point:

Insert Figures 3 & 4

Scripts

Several writers have advanced the level of network theory to encompass interrelationships among concepts (Lehnert, 1975; Pearson and Nicholson, 1976). These writers contend that scripts are useful models to describe human memory organizations. Scripts are defined as memory units containing information about situations that are encountered with regularity. They are expectations about everyday happenings. We have so much experience with these happenings that we take for granted or predict what will occur. Thus, when you attend class, you have internalized your expectations. When you later read about situations similar to attending class, you are able to make accurate predictions regarding outcomes. That is, your "attending class script" is a valuable asset in predicting

Figure 3

EXAMPLES OF NETWORK REPRESENTATION ASSESSMENT PICTORIALLY PRESENTED

Which animal is huge?

5

(Karlsen, Madden, & Gardner, 1975)

Which thing has been woven?

12

(Karlsen, Madden, & Gardner, 1975)

A The ball is big.

(Karlsen, Madden, & Gardner, 1975)

10	turn	fence	clip
11	climb	since	felt
12	whole	over	other

(Karlsen, Madden, & Gardner, 1975)

When two things are much the same, they are

14 alike ● alone ○ large ○

To giggle means to

16 chatter ○ joke ○ laugh ●

(Karlsen, Madden, & Gardner, 1975)

Not just anybody is permitted to drive a huge semi-trailer truck long distances. Drivers must have healthy bodies as well as keen sight and hearing. They must know a lot about the truck, the driving laws of many states, and how to drive in different kinds of weather. They learn these competencies in special schools.

Drivers also learn what to do in an emergency. They carry fire extinguishers and first-aid kits, as well as flashlights, flares, and lanterns.

11. Competencies are
A. duties.
B. ideas.
(C) skills.
D. tricks.

12. Flares are
A. bandages.
B. road maps.
C. stretchers.
(D) warning lights.

(Hanna, Schell, & Schreiner, 1977)

1. House
(A) home
B. live
C. mother
D. water

9. Difficult
A. bad
(B) hard
C. alone
D. regular

(Hanna, Schell, & Schreiner, 1977)

meanings. You expect the instructor to arrive with notes in hand, take roll, deliver the lecture and ask questions. As in the case of grammatical surface structure situations, you are only surprised when these events do not occur in their predictable sequences. Further, scripts are acquired through extensive cognitive experiences. You generalize your expectations about situations to the limit of the experiences you have had previously.

Some efforts have been made using scripts in story grammar to determine meanings of folktales and myths (Mandler and Johnson, 1977). They suggest that in stories representing the oral tradition, such as folktales, subjects have predispositions about the internal structure which facilitate both encoding and retrieval. The term "story schema" refers to the set of expectations about internal structure. Story schemata come from two sources: Listening to many stories and internalizing knowledge about the sequencing of events within a story. The knowledge consists of typical beginnings (settings), plot, roles of antagonists, protagonists, conflict resolution, and endings. The other source comes from general knowledge about causal relations and various kinds of action sequences. It is suggested that only those perceptions, feelings, actions and events which have to do with the ongoing plot or story line are represented in the story schema. Thus, encoding is aided by story specific content.

Mandler and Johnson describe a story schema as follows:

> During encoding, the schema acts as a general framework within which detailed comprehension processes take place. This framework performs several functions. First, it directs attention to certain aspects of the incoming material. For example,

> statements in the setting of a folktale . . . are always relevant to later events; they warn the listener that certain facts should be kept in mind. Second, the framework helps the listener keep track of what has gone before. It provides a summary that increases the predictability of what will immediately follow. Third, the framework tells the listener when some part of the story is complete and can therefore be stored, or is incomplete and therefore must be held until more material has been encoded. (Mandler and Johnson, p. 112, 1977)

This explication ought to invoke, in any English teacher's "script," a sense of reassurance. This research provides some satisfaction in knowing that when teaching literary devices we were engaging in semantic encoding and retrieval activities! Data from script and schema research may prove useful in establishing standards of construct validity in the assessment of reading comprehension.

Some of the following examples illustrate items that reflect the script representational level:

Insert Figures 5 & 6

The examples of various types of test items were selected from standardized measures of reading comprehension. There are, of course, several activities that can be used as informal reading comprehension assessment techniques.

Many image level representation responses could be provided by students. Verbal messages could easily be pictured by students and the

Figure 5

EXAMPLES OF SCRIPT REPRESENTATION ASSESSMENT, PICTORIALLY PRESENTED

34	card ○	bags ●	bark ○
35	string ○	some ○	store ●
36	stone ○	grow ○	carry ●

(Karlsen, Madden, & Gardner, 1975)

Circle the picture in which the lady is not in the garden.

(Lorge, Thorndike, & Hagen, 1964)

Which picture shows a flood?

6

○ ● ○

(Karlsen, Madden, & Gardner, 1975)

Figure

EXAMPLES OF SCRIPT REPRESENTATION ASSESSMENT IN WRITTEN DISCOURSE

For breakfast Pat had eggs, milk, and toast. Her brother Alan had corn flakes and a roll. Mother drank coffee and ate a roll. Father had already eaten and left.

2. What time of day was it?
   - (A) Morning
   - B. Noon
   - C. Afternoon
   - D. Night

5. Who is Pat?
   - A. The brother
   - (B) The sister
   - C. The father
   - D. The mother

(Hanna, Schell, & Schreiner, 1977)

Maria's pencils kept falling to the floor. Danny's spelling paper turned up in Lisa's reader. One day the clock would be fast, the next it would be slow. Twice Mr. Garcia's chair was on his desk. Sam found both Susan's and Lee's scissors in a library book. And once when everybody came in from recess on the playground, "BOO!" was written on the board. Yet nobody ever saw the prankster. Could it have been a ghost?

26. This story probably takes place
   - A. at church school.
   - (B) in a schoolroom.
   - C. in the library.
   - D. on the playground.

31. Which title best describes this paragraph?
   - (A) The Unseen Prankster
   - B. Halloween Happenings
   - C. Lost and Found
   - D. Danny and the Ghost

(Hanna, Schell, & Schreiner, 1977)

responses be construed as representations of semantic encoding processes. While these "messages" may not be too elegant, they could be an indication of an individual's level of comprehension.

Several questioning strategies could easily be generated to assess network levels of semantic encoding or retrieval. Students could be asked to provide attributes of concepts as written responses. Activities could be devised whereby teachers provide attributes and students infer the concept from a list of critical classes, features or examples. Any combination of arrangements could be developed with these activities. The cloze technique appears to be a rich resource for items and activities that assess network processing. In all instances students are required to provide missing elements in messages. These elements can be systematically deleted to illustrate interrelationships among concepts. The cloze approach would also be highly useful in assessing student's perceptions of script representations.

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